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ABSTRACT

During the 1998-99 academic year, five teacher education institutions participated in the first year of a study to determine the impact of teacher preparation programs on beginning teachers. This collaboration, known as the Teacher Research Network (TRN), met several times during the academic year and the following summer to investigate recent research activities on beginning teachers, to review current scholarly work on the topic, and devise a specific plan of study for the TRN that would consider Minnesota's needs and resources for addressing the issue. The TRN piloted a quantitative instrument developed in the Salish Project entitled the Constructivist Learning Environment Survey (CLES) and a qualitative instrument called the Science Teacher Observation Instrument (STOI), which was developed after considerable investigation into components of the INTASC standards, Minnesota Teacher Preparation Standards, and the effective teaching literature. Two versions of the CLES were developed, entitled CLESS in the modified form, one for the teacher's perspective and another for the student's perspective. The remaining parts of this report describe the developments of the CLESS and the STOI. The CLESS, STOI, and Teacher Observation Form Rubric instruments are appended at the end of this report. (VWC)

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Assessing the Constructivist Classroom

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Assessing the Constructivist Classroom

Introduction

During the 1998-99 academic year five teacher education institutions participated in the first year of a study, funded by SciMathMN, to determine the impact of our teacher preparation programs on beginning teachers. This collaboration, known as the Teacher Research Network (TRN) met several times during the academic year and following summer to investigate recent research activities on beginning teachers, to review current scholarly work on the topic, and to devise a specific plan of study for the TRN that would consider our needs and resources for addressing the issue.

The result was a pilot project designed to implement and refine instruments for measuring beginning teacher effectiveness as defined from a constructivist and national standards perspective. After considerable investigation, the TRN decided to pilot a quantitative instrument developed in the Salish Project entitled the Constructivist Learning Environment Survey, and a qualtitative instrument developed after considerable investigation into components of the INTASC standards, Minnesota Teacher Preparation Standards, and the effective teaching literature, referred to as the STOI (Science Teacher Observation Instrument) (Appendix C). An associated rubric was developed for scoring the STOI (Appendix D). Two versions of the CLES were developed, one for the teacher's perspective and another for the students' perspective. Other instruments were involved in this pilot but were not considered for inclusion in this paper.

Development of the CLESS

The classroom learning environment is the social atmosphere in which learning takes place. Fraser (1994) regards these learning environments as "the social-

psychological contexts or determinants of learning. Several studies have supported the significance of learning environment in predicting students' attitudes toward learning (Cannon, 1997, Niederhauser, et. al., 1999). Cannon (1997) argued that classroom learning environment was the strongest predictor of student attitude toward science in all grades. The CLES was developed to "enable teacher-researchers to monitor their (teacher) development of constructivist approaches to teaching school science..." (Taylor, Dawson, and Fraser, 1995).

The CLES instrument (Taylor, Dawson, and Fraser, 1991) was originally developed with 28 items in four scales – autonomy, prior knowledge, negotiation, and student-centeredness. A revised version with 30 items in five scales (personal relevance, uncertainty, critical voice, shared control, and student negotiation) was later created (Taylor, et. al., 1995) and was used in our pilot during the spring of 1999.

The CLES instrument was piloted to 290 pre- and in-service teachers. The results of the 290 surveys were then used in an exploratory factor analysis to determine reliability amongst the items. The results supported the use of the five-scale structure but revealed nine items that did not appear to go with others in their scale. A look at squared multiple correlations for the particular items, though, revealed seven items that did not appear to go well with others in their scale. Comments were also gathered from participants taking the CLES. Frequently redundancy amoung items was identified as a distraction in the instrument.

As a result of the analysis we determined that two items from each scale needed to be dropped, and that fourteen items needed to be reworded for the teacher version. Additional clarification was directed toward the student version to make it more clear for

use at the upper elementary level. These instruments were then used as a basis for deterimining the versions developed for CLESS (Appendices A and B). We used the NCSS Standards document as our guide for modifying the CLES. We found that only minor modifications needed to be made to the science document. Of primary concern was differentiating the local community with the world within the instrument to emphasize the developmental nature of the social sciences expressed within the Standards.

Development of the STOI

During the spring of 1996 math, science, and education faculty paired up with teachers from area school districts around Winona, Minnesota in an effort to develop a learner-centered instructional model (LCIM) for classroom assessment of student teachers. It was through these initial stages of instrumentation design that lead to our further refinement and testing of an effective constructivist teacher observation instrument.

Based upon the Learner-Centered Instructional Model teacher observation instrument that was developed back in 1996, a team of three faculty members at Saint Mary's University of Minnesota led by Dr. David Jackson revised the LCIM instrument to be more aligned with the CLES instrument. Since our education faculty wanted to determine to what degree students were utilizing constructivist teaching strategies once they entered their classrooms, we decided that our instrument needed to reflect not only how effective the teachers were, but to determine how they were bringing about learning in their classrooms. To accomplish this, we relied heavily on observable traits that would reflect constructivist-teaching techniques.

Maintaining the scripting nature of the LCIM instrument the revised STOI document was created and structured to have the observer look for constructivist techniques espoused under the State of Minnesota teacher preparation standards. These standards and the focus elements of these standards are listed in the table below:

Table 1. Components of the Student Teacher Observation Instrument

Minnesota Pre-service Teaching Standards	Elements to be Observed
Standard 1, Subject Matter	Structuring of content/concepts, inquiry, teacher seeks student input, student needs drive curriculum, connections to student experiences, life, other disciplines, and future
Standard 3, Diverse Learners	Student perspectives are valued, multiple perspectives on issues are presented, learning process is valued, adaptations, fairness, multi-modal instruction
Standard 4, Instructional Strategies	Students engaged in higher order thinking, active learning, and student responsibility for learning
Standard 5, Learning Environment	Mutual respect, students involvement in solving classroom climate issues, handling of fairness, judicial, restitution, safe environment both emotionally and physically
Standard 6, Communication	Principles of speech and writing, clarity, multiple cues, media use, questioning, learner-to-learner interaction
Standard 8, Assessment	Frequent, formal/informal, feedback during the learning process, adjust instruction, self and peer assessment included

Following the development of the teacher observation instrument, a scoring rubric was designed that aligned itself with how constructivist an observed lesson was.

This instrument was tested in the spring of 1999 for ease of use. The instrument proved to be an effective tool in helping explain the constructivist level of a teaching lesson when used to discuss what the observations that were made with the teacher. It became apparent that pre- and post- conferences were needed to determine where the lesson fit into the structure of learning and working with concepts.

In the fall of 1999, a group of Minnesota Sci-Math educators met to re-engage in the refinement of this instrument. During this two-day workshop, the better part of one day was spent reshaping what is now known as the Science Teacher Observation Instrument (STOI). After reviewing the document that was developed last spring, the Sci-Math educators decided to break these standards down to their most basic level and rebuild them in their own words. The result is a teacher observation document that places much emphasis on teaching in a constructivist manner. The observation instrument now reflects the input of university faculty from across the State of Minnesota. While this instrument may see further refinements in the years to come, it has been designed with great care and purpose to get at the level and quality of constructivist teaching taking place in a classroom.

Conclusion

Use of this constructivist teacher observation instrument along with the revised paper and pencil CLESS instrument should assist greatly in determining the level and quality of constructivist teaching taking place in a teacher's classroom. The use of pre- and post-teacher interviews became apparent through the development and implementation of this instrument. With information gathered from student feedback on the CLESS, teacher's response on the CLESS, and an outside observer utilizing the STOI: the researcher should see similar results from all three instruments with regard to the constructivist nature of the classroom.

Resources

Cannon, John R. (1997). The constructivist learning environment survey may help halt student exodus from college science courses. Journal of College Science Teaching. Sept./Oct/ 1997.

Fraser, B. (1994). Research on classroom and school climate. In Handbook of Research on Science Teaching and Learning. Ed. D. Gable. Washington, D.C.: National Science Teachers Association.

Niederhauser, Dale S.; Salem, Donna J.; Fields, Matt (1999). Exploring teaching, learning, and instructional reform in an introductory technology course. Journal of Technology and Teacher Education. Volume 7, #2.

Taylor, P., Dawson, V., and Fraser, B. (1995, April). Classroom learning environments under transformation: A constructivist perspective. Paper presented at the Annual Meeting of the American Research Association, San Francisco, CA.

Taylor, p. and Fraser, B. (1991). CLES: An instrument for assessing constructivist learning environments. Paper presented at the National Association for Research in Science Teaching. Fontane, WI.

APPENDIX A

What Happens in My Social Science Classroom--Teacher Form

1) Purpose of the questionnaire:

This questionnaire asks you to describe your perceptions of important aspects of the science classroom in which you teach. There are no right or wrong answers. Your opinion about what you see in your classroom is what is wanted.

2) How to answer each question:
On the next few pages you will find 20 sentences. For each sentence, *circle only one number* corresponding to your answer.

Example:

In this class…	Almost Always	Often	Some-times	Seldom	Almost Never
Students pay attention to each other's ideas.	5	4	3	2	1

- If you think that students in this class *almost always* pay attention to other's ideas, circle the letter "5".
- If you think that students in this class *almost never* pay attention to other's ideas, circle the letter "1".
- Or you can choose the letter "B", "C", or "D" if one of these seems like a more accurate answer.

3) Filling in the answer sheet.
When you are finished, you will be instructed to fill in the corresponding answers on the "bubble" answer sheet.

4) Completing the questionnaire
Please give an answer for <u>every</u> question.

Learning about the world

In this class…		Almost Always	Often	Some-times	Seldom	Almost Never
1.	Students learn about the world in and outside of school.	5	4	3	2	1
2.	New learning relates to experiences or questions about the world in and outside of school.	5	4	3	2	1
3.	Students learn how social science is part of their in and out-of-school life.	5	4	3	2	1
4.	Students learn interesting things about the world in and outside of school.	5	4	3	2	1

Learning about science
In this class…

5.	Students learn that social science cannot always provide answers to problems.	5	4	3	2	1
6.	Students learn that explanations have changed over time.	5	4	3	2	1
7.	Students learn that social science is influenced by people's cultural values and opinions.	5	4	3	2	1
8.	Students learn that social science is a way to raise questions and seek answers.	5	4	3	2	1

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		Almost Always	Often	Some times	Seldom	Almost Never
Learning to speak out						
In this class...						
9.	Students feel safe questioning what or how they are being taught.	5	4	3	2	1
10.	Students feel they learn better when they are allowed to question what or how they are being taught.	5	4	3	2	1
11.	It's OK for students to ask for clarification about activities that are confusing.	5	4	3	2	1
12.	It's acceptable for students to express concern about anything that gets in the way of their learning.	5	4	3	2	1
Learning to learn						
In this class...						
13.	Students help me to plan what they are going to learn.	5	4	3	2	1
14.	Students help me to decide how well they are learning.	5	4	3	2	1
15.	Students help me to decide which activities work best for them.	5	4	3	2	1
16.	Students let me know when they need more/less time to complete activities.	5	4	3	2	1
Learning to communicate						
In this class...						
17.	Students talk with other students about how to solve problems.	5	4	3	2	1
18.	Students explain their ideas to other students.	5	4	3	2	1
19.	Students ask other students to explain their ideas.	5	4	3	2	1
20.	Students are asked by others to explain their ideas.	5	4	3	2	1

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APPENDIX B

What Happens in My Social Science Classroom--Teacher Form

1) Purpose of the questionnaire:

This questionnaire asks you to describe your perceptions of important aspects of the science classroom in which you teach. There are no right or wrong answers. Your opinion about what you see in your classroom is what is wanted.

2) How to answer each question:
On the next few pages you will find 30 sentences. For each sentence, *circle only one number* corresponding to your answer.

Example:

	Almost Always	Often	Some-times	Seldom	Almost Never
In this class…					
Students pay attention to each other's ideas.	5	4	3	2	1

- If you think that students in this class *almost always* pay attention to other's ideas, circle the letter "A"
- If you think that students in this class *almost never* pay attention to other's ideas, circle the letter "E"
- Or you can choose the letter "B", "C", or "D" if one of these seems like a more accurate answer.

3) Filling in the answer sheet.
When you are finished, you will be instructed to fill in the corresponding answers on the "bubble" answer sheet.

4) Completing the questionnaire
Please give an answer for every question.

Learning about the world

In this class…		Almost Always	Often	Some-times	Seldom	Almost Never
1.	Students learn about the world in and outside of school.	5	4	3	2	1
2.	New learning relates to experiences or questions about the world in and outside of school.	5	4	3	2	1
3.	Students learn how social science is part of their in and out-of-school life.	5	4	3	2	1
4.	Students learn interesting things about the world in and outside of school.	5	4	3	2	1

Learning about science
In this class…

5.	Students learn that social science cannot always provide answers to problems.	5	4	3	2	1
6.	Students learn that explanations have changed over time.	5	4	3	2	1
7.	Students learn that social science is influenced by people's cultural values and opinions.	5	4	3	2	1
8.	Students learn that social science is a way to raise questions and seek answers.	5	4	3	2	1

		Almost Always	Often	Some-times	Seldom	Almost Never
Learning to speak out						
In this class...						
9.	Students feel safe questioning what or how they are being taught.	5	4	3	2	1
10.	Students feel they learn better when they are allowed to question what or how they are being taught.	5	4	3	2	1
11.	It's OK for students to ask for clarification about activities that are confusing.	5	4	3	2	1
12.	It's acceptable for students to express concern about anything that gets in the way of their learning.	5	4	3	2	1
Learning to learn						
In this class...						
13.	Students help me to plan what they are going to learn.	5	4	3	2	1
14.	Students help me to decide how well they are learning.	5	4	3	2	1
15.	Students help me to decide which activities work best for them.	5	4	3	2	1
16.	Students let me know when they need more/less time to complete activities.	5	4	3	2	1
Learning to communicate						
In this class...						
17.	Students talk with other students about how to solve problems.	5	4	3	2	1
18.	Students explain their ideas to other students.	5	4	3	2	1
19.	Students ask other students to explain their ideas.	5	4	3	2	1
20.	Students are asked by others to explain their ideas.	5	4	3	2	1

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APPENDIX C
Constructivist Teacher Observation Instrument

May, 1999

The teacher observation form on the following page was first designed by a core of university personnel in the areas of science, math and education along with a core of K-12 educators. The early version of these forms was completed with a focus on what the committee viewed as effective teaching in a math/science classroom. Following this past winters SciMath meetings in the Twin Cities we adapted these teacher observation forms known as Learner Centered Instruction Model observation forms and revised them to align with the CLES Instrument.

The teacher observation form that is included in this document represents the result of this alignment. For those of you who have utilized teacher observation instruments based upon scripting and scoring such as Pathwise, this instrument relies upon the observer to be able to recognize critical elements of pedagogy.

This instrument was field tested only once in a high school physical science classroom. While no judgements could possibly be made upon how well this instrument aligns with the CLES, it did manage to get at several key factors dealing with effective teaching and elements associated with constructivist teaching. One of the drawbacks to aligning this form with the CLES instrument is that the CLES instrument is really taking a look at philosophical belief structure of the teacher without as much concern to whether the teacher is operating effectively in the classroom.

If I wished to create a teacher observation form that is more closely aligned with the CLES instrument, I would create an observation instrument by starting with the critical components of constructivist teaching and building in observable traits that an evaluator could focus in on during a classroom observation.

Which instrument is of more value a teacher observation instrument that combines constructivism an effective teaching traits or an instrument that more narrowly seeks out constructivist pedagogy? That depends upon many factors. Feel free to use this form or any alterations to this form that you wish to make. If you are working either with this form or creating a new form, I'd be interested in hearing from you.

Teacher Observation Form

Combination of Learner Centered Instruction Model and CLES Instrument

Teacher:	Observer:	Date:

Foundation Knowledge/Student Involvement with Learning

Structuring of content/concepts, inquiry, teacher seeks student input, student needs drive curriculum, connections to student experiences, life, other disciplines, and future

Student Involvement Score

Classroom Climate

Mutual respect, students involvement in solving classroom climate issues, handling of fairness, judicial, restitution, safe environment both emotionally and physically

Classroom Climate Score

Learner Diversity/Multiple Perspectives

Student perspectives are valued, multiple perspectives on issues are presented, learning process is valued, adaptations, fairness, multimodal instruction

Multiple Perspective Score

Teacher Observation Form

Teacher:	Observer:	Date:

Communication

Principles of speech and writing, clarity, multiple cues, media use, questioning, learner-to-learner interaction

Communication Score

Assessment

Frequent, formal/informal, feedback during the learning process, adjust instruction, self and peer assessment included

Assessment Score

Promoting Thinking

Students engaged in higher order thinking, active learning, and student responsibility for learning

Promoting Thinking Score

Summary Remarks/ Targeting Future Learning

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APPENDIX D

Teacher Observation Form Rubric

Combination of Learner Centered Instruction Model and CLES Instrument

Foundation Knowledge/Student Involvement with Learning

Structuring of content/concepts, inquiry, teacher seeks student input, student needs drive curriculum, connections to student experiences, life, other disciplines, and future

4 - Teacher actively seeks student input on what, why, and how content is being taught. Content is messed with the needs of the student. Content is adjusted to the needs of students and inquiry is utilized as part of the lesson.
3 - Teacher seeks student input into what is being taught although little focus is given to either why or how the subject is taught. Content is appropriate and inquiry is used.
2 - Teacher seeks student input with regards to what is being taught learning.
1 - Teacher does not seek any student input in the process of teaching.

Classroom Climate

Mutual respect, students involvement in solving classroom climate issues, handling of fairness, judicial, restitution, safe environment both emotionally and physically

4 - There is mutual respect between teacher/student and student/student relationships. There is evidence that students are taking ownership of their attitudes/classroom culture.
3 - There is mutual respect between teachers and students. Student to student interaction shows some signs of disrespect. Teacher takes primary responsibility for inappropriate student to student interaction.
2 - Classroom climate is primarily dictated by teacher selected rules with little or no student input.
1 - Respect between teacher and students is not evident.

Learner Diversity/Multiple Perspectives

Student perspectives are valued, multiple perspectives on issues are presented, learning process is valued, adaptations, fairness, multimodal instruction

4 - Both the teacher and the students engaged in presenting multiple perspectives of the topic. The lesson took in account the diversity of the learners with appropriate adjustments to meet individual needs.
3 - The teacher presented the topic from multiple perspectives without seeking the views of their students. The teacher was willing to make accommodations to individual learner needs.
2 - The teacher presented the topic from multiple perspectives without seeking the views of their students. When students contributed their perspectives, the teacher did not seem to value their responses.
1 - The teacher presented only a very narrowed view of the topic. The teacher did not seek to understand how the student viewed the lesson.

Teacher Observation Form Rubric

Combination of Learner Centered Instruction Model and CLES Instrument

Communication

Principles of speech and writing, clarity, multiple cues, media use, questioning, learner-to-learner interaction

4 - The communication was clear and concise. The teacher utilized multiple cues, higher level questioning with delving. Students engaged in learner to learner interaction that facilitated new ideas and questions.
3 - The communication was clear and concise. The teacher utilized multiple cues, higher level questioning with delving, but did little to encourage learner to learner interaction.
2 - The communication was difficult to follow.
1 - The communication represented poor grammatical use of the English language.

Assessment

Frequent, formal/informal, feedback during the learning process, adjust instruction, self and peer assessment included

4 - The teacher provided structure for student self-reflection, peer feedback and provided constructive feedback geared to assist student with future learning.
3 - The teacher provided both formal and informal feedback that was geared to assist student with future learning.
2 - The teacher provided summative feedback on student work with little formal assessment.
1 - There is a lack of feedback to students.

Promoting Thinking

Students engaged in higher order thinking, active learning, and student responsibility for learning

4 - Students actively engaged themselves and each other in producing work requiring higher order thinking skills. Teacher was a part of the resources students utilized with seeking answers/guidance.
3 - Students are engaged in higher order thinking skills with active guidance from the teacher.
2 - Students are actively engaged with the curriculum at a lower level thinking skills.
1 - Students are disengaged from the thinking process.